euresis journal

euresis
Association for the Promotion of the Scientific Endeavour

Volume 5
Summer 2013

journal homepage
www.euresisjournal.org

Science, reason and truth. An interdisciplinary engagement

Marco Bersanelli[1], Charles L. Harper Jr[2] and Peter van Inwagen[3]

[1] Università di Milano, Dipartimento di Fisica, Via Festa del Perdono 7 - 20122 Milano, Italy. Marco. Bersanelli@fisica.unimi.it
[2] The John Templeton Foundation, Templeton Foundation Press, 300 Conshohoken State Road, Suite 550 - West Conshohocken, PA 19428 USA. clharperjr@gmail.com
[3] University of Notre Dame, Dept. of Philosophy, 100 Malloy Hall, Notre Dame, IN 46556-4619 USA. Peter.VanInwagen.1@nd.edu

Abstract

"In some strange way, any new fact or insight that I may have found has not seemed to me as a discovery of mine, but rather as something that had always been there and that I had chanced to pick up. These words by the great astrophysicist Subramanyan Chandrasekhar, Nobel laureate in physics in 1983, beautifully describe a fundamental trait of scientific knowledge. While there is no progress in science without the systematic application of a rigorous methodology, surprise and unexpectedness are often components of scientific discoveries at all scales, from the daily advances in an average research laboratory to the major breakthroughs of quantum mechanics and relativistic physics in the twentieth century. The progress of science continuously opens up wider horizons on the physical world and new findings often challenge our imagination and common sense. To cite a recent example, cosmologists have come to understand that almost all our universe, something like 95% of its mass-energy content, is composed of two distinct unknowns, an unknown kind of energy and an unknown kind of matter. We have stumbled on the evidence for this state of affairs with no premonition of the existence of these things. These gigantic discoveries were a complete surprise to everybody. Science can be like that.

1. The San Marino 2007 Symposium

The statement by Chandrasekhar seems to point to something that is not confined to the natural sciences, rather, it indicates a feature that is common to many other fields of investigation. For every discipline, whatever the methods it employs, truth is something out there to be discovered: it is not a product of definition, it is not constructed by human thought, but it is rather the result of an encounter with a reality outside the investigator. It is something that —on occasion— we happen to bump into without prior notice.

This issue of Euresis Journal hosts a number of contributions presented at the 2007 edition of the San Marino Symposium on *Science, reason and truth*. Due to a number of unfortunate circumstances – independent from the San Marino Symposium organization – these proceed-

ings are published quite late; however, the central content of each paper remains perfectly valid and, when relevant, revisions have been applied by the authors. The theme of the San Marino Symposium was inspired by the title of the Rimini Meeting of that year: Truth is the destiny for which we have been made. These words, taken from a book by Don Luigi Giussani, are suggestive of the yearning for an ultimate meaning that characterises human experience. Indeed, every positive human act, relationship or investigation can be seen as an expression of our deep yearning for truth. Of course, as soon as we betray our original direction to truth, we are involved in many aspects of deception as well. One of the most attractive aspects of scientific and philosophical inquiry is that they are focused directly and formally on truth-seeking. Our search for truth takes different forms, and is carried out in accordance with a variety of cognitive methods. In particular, attention to the theme truth is inevitable for those who work in scientific research. Around the theme set forth by the Rimini Meeting, a group of scientists and scholars from Europe and the United States organized an academic symposium whose goal was to investigate —from a wide range of disciplinary perspectives— the dynamics of human reason when it is engaged in scientific research.

Under the title *"Science, Reason and Truth"*, the symposium was jointly sponsored by Euresis and the John Templeton Foundation, in collaboration with the University of San Marino. The beautiful ancient Monastery of Santa Chiara, now the main building of the University of San Marino, was a perfect setting for the presentations and discussions, which took place on 17-19 August 2007, immediately before the 2007 Rimini Meeting.

The invitation to the participants, reflected in the papers collected in this issue, was to discuss topics in the specific disciplines mastered by each speaker and to explore their connection with fundamental issues of reason and truth, as emerging from within that discipline. So we addressed such questions as, What use do we make of our reason when we carry out our scientific research? and In what sense can we speak of truth in connection with the sciences? Ultimate questions of meaning and purpose where therefore at stake, both in the talks and in the discussions, calling for the philosophical positions or religious beliefs of the speakers. However, this was not a science and religion workshop in the usual sense of the phrase: the contents were driven by open dialogue based on personal experience rather than by abstract apologetic or agnostic discourses.

It is not common for scholars of different disciplines to meet to face questions that lie at the foundations of their own research, and express the deepest motivations and the meaning of their work. The debate was passionate, sometimes not easy, and always interesting. The dialogue among distinguished scientists from different fields (such as Mathematics, Physics, Cosmology, Geology), philosophers and theologians, in an open and friendly atmosphere, has been a uniquely enriching experience. We believe that everyone left the Symposium having learned something important and with a greater desire to learn more. At the end, it was clear that the popular view of how science works —according to the empirical and positivistic

view— falls short of what its reality actually is. It also clearly emerged an increasing desire for a unity of knowledge, not as a questionable wish to return to the past, but rather as a forthcoming, post-modern model yet to be elucidated. The paper by Keith Ward, in particular, provides an interesting, explicit example.

The three key words of the title of the symposium (science, reason and truth) marked the three sessions of the debate. We have maintained the same structure in the organization of the papers in this EJ issue. It will be clear to the reader, however, that there are many points of contact —indeed, a rich set of interconnections— among the various contributions well beyond the distinction set by the three sessions.

1.1 Science, a passionate search

An important aspect of science is the adventure of seeking and understanding deep rational order in nature. Scientists strive to achieve a systematic and synthetic description of the complexity of physical phenomena, with an indomitable hope to discover fundamental laws of nature behind them. But is there a limit to the extent to which we can know the universe? And what are these laws of nature that the physical world appears to obey with astonishing faithfulness? The contribution by physicist and cosmologist Paul Davies proposes an original and ambitious hypothesis concerning the underlying reality of the laws of nature. Traditionally, natural laws are considered as immutable mathematical relationships, infinitely precise, somehow impressed in the universe from outside. Davies suggests, however, that this may be an idealization. Physical laws may in fact have developed, this development being constrained by the amount of information that the universe can contain at any given time. Just like in a man-made computer, no law can be applied in a system to a level of precision finer than all the information that system can express. In the present universe the information content is huge. However, just after the big bang, when the basic physical properties were being set, the cosmic information capacity was much smaller and the laws may therefore have been quite fuzzy. This "wiggle room" in the laws, suggests Davies, perhaps was enough for the universe to engineer its own bio-friendliness. Davies discusses the consequences of this idea and its implications for the relationships between the form that physical laws take and the emergence of life and consciousness. The philosopher Nancy Cartwright also questions the notion that laws are immutable, but from a widely different viewpoint than that offered in Davies paper. She cites authors that claim that biological laws are contingent, and discusses the nature of scientific laws and the limitations on order that are intrinsic to nature. She points out that Western science and Christian theology have supported a view of nature as fully ordered by deterministic laws, an image that has not been substantially modified by quantum mechanics. She suggests, however, that in the last twenty years this paradigm has been breaking down, a development that according to Cartwright can be seen by a detailed analysis of recent changes in scientific practice both in the biological sciences and in economics. She also claims, rather controversially, that even the world of physics is ordered

by laws only in patches, and with gauzy edges, a point that –as the reader can imagine– generated lively discussion in the workshop.

How does a novel scientific truth enter the horizon of human experience? What is the purpose and the context of scientific knowledge? The paper by theologian and philosopher David Schindler deals with the relationship between natural sciences and theology, a relationship that is described in terms of mutual but asymmetrical implication. Scientism and reductionism are criticized in the course of a reflection on the concept of abstraction, a concept to which according to Schindler conventional discussions of the relation between the natural sciences and theology have paid insufficient attention. Scientism and reductionism result from the failure to observe the limits of science. Such problems are avoided when one recognizes that science does not exhaust the width of human reason and its ability to understand reality. On the other hand, there is a tendency to regard science as an activity essentially independent from the human persons who are actually engaged in it. But what is the role of the personal characters and human attitude of those engaged in the daily battle of scientific research? Cosmologist Marco Bersanelli suggests that scientists who are actually engaged in the battle of scientific research, in order to move towards new knowledge and discovery use a much wider range of rational and affective capabilities than is usually assumed. Scientific knowledge is often perceived as the result of a set of rigorously defined procedures, based on experiment and logical-deductive reasoning. However, looking at the actual experience of distinguished scientists, one can see how wonder and an aesthetic attraction to natural phenomena are essential to initiate and to maintain scientific interest, curiosity, and imagination. A deep regard for the ultimate questions of meaning, origin and destiny appears to act as a decisive —though often implicit— motivation for the creativity and dedication of many great scientists.

1.2 Reason: an open window on reality

In the second session, which is focused on reason, the contributors discuss the rational adventure of knowledge from the perspective of their scientific and personal experience. What factors establish a new paradigm in a scientific discipline? Geologist Xavier Le Pichon was one of the key players in the revolution in geology that happened between 1966 and 1968, when the theory of plate tectonics replaced previous models of the Earths crust. In his paper, Le Pichon gives an entertaining, first-hand account of the events by which, in those years, the new paradigm was accepted and adopted by almost all geologists. In the process he sheds light on the scientific process and how it converges toward truth. Interestingly, he points out that there was at that time no actual demonstration of the validity of plate tectonics. A true demonstration of the validity of the model was achieved gradually during the following 20 years as more accurate techniques of measurement became available. Le Pichon thus emphasises the pragmatic character of experimental sciences, which tend to promote the view that best explains the observations, even if that view has not been conclusively demonstrated to

be correct.

The concept of reason has changed significantly throughout history. When its capacities have been exaggerated, when reason has been treated as the only source of truth and the only guide to values, its scope and effectiveness have been, paradoxically, much reduced. In his paper, philosopher and theologian Keith Ward reflects on reason from a historical perspective, in particular by examining the Age of Enlightenment in 18th Century Europe, from Diderot and Voltaire, to Hume, to Hegel. For Ward, reason —and hence science— alone cannot resolve the ultimate questions, those about the meaning of existence, the human person, the ultimate nature of reality. Ward argues for a new, comprehensive view of reason and for the creative construction of a coherent, plausible metaphysics. The intelligible cosmos disclosed by modern science is one part of such a metaphysics, but not the whole: such a metaphysics will also include the dimensions of value, purpose and meaning found in personal experience. Science, in this view, is seen as a rational enterprise that is one important part of the realm of reason.

The question of how human reason recognises scientific truth has deep relationship with mathematics. The paper by mathematician Harvey Friedman summarizes some fundamental results that stem from the work of Turing and Gdel. These results, partly presented in a rather technical language, entail that our ability to decide the truth or falsity of mathematical assertions in a number of important mathematical contexts has significant limitations. Friedman goes on to discuss recent advances in our knowledge of different kinds of limits on what can be decided in mathematics, as well as limits (undecidability) on what can be known in simplified physical systems. The cognitive sciences help us to realize the intrinsic inseparability of perception of the other and knowledge of the world. Philosopher Eleonore Stump maintains that knowledge of the world provided by academic disciplines, including the sciences, is not sufficient to fulfil the formation of a human being. It needs to be accompanied by knowledge of others through second-person experiences and narratives (story-telling). Stump illustrates the role of second-person experiences by comparing the mental states in normal children with those of autistic children, whose human cognitive capacities are impaired and who lack an intuitive knowledge of persons and their mental states. Recent discoveries in this field illuminate the nature of second-person experience and are highly suggestive both for epistemology and the philosophy of art. It is interesting to see, in this respect, the connection of Stumps paper with those by Hodgson, Ward and Bersanelli, who in widely different contexts indicate human attitude and relationship as key elements in scientific discovery.

1.3 The unmistakable fascination of truth

The great physicist Victor Weisskopf, one of the founders of quantum mechanics, noted that every scientist, either consciously or unconsciously, has an intuition of a meaning: otherwise, he would not go on with that ardor so common among scientists, in his quest for something

that he calls truth. Where does this quest for truth originate? What role does a desire for truth play in scientific research? The third and last session in the Symposium focussed on truth — and particularly on the idea that truth is a goal of scientific research.

What do we mean when we say that truth is a goal of scientific research? Human reason has displayed great agility and has employed a great variety of resources in its attempts to reach true conclusions. What role do human qualities such as creativity or the ability to trust others play in the search for truth? Even in scientific research the emergence of a new achievement is not the result of a mechanism. It is, rather, an outcome of the convergence of a set of diverse clues, often gathered through a patient devotion to observation and experiment. Physicist Peter Hodgson points out that the way to truth in science is not a linear process starting from observations and experiments and leading to a logical conclusion as is often described in textbooks. He argues that, for both scientists and theologians, truth is usually obtained by a process involving the cumulative convergence of many different indications, none of which is conclusive by itself, but all of which point in the same direction. He discusses, as historical examples, the theory of the atom and the heliocentric model of the solar system. Interestingly, the paper by Le Pichon, describing the emergence of the plate tectonics, provides a further clear example: there was no single line of evidence that was conclusive enough, but it was the convergence of many indications that introduced credibility to the new paradigm. Hodgson also points out that a similar process occurs in theology. Newman called the human capacity on which way of knowing rests the illative sense. The concept of truth in science raises questions peculiar to mathematics. The concepts of truth and of proof in mathematics have undergone important changes in the course of the history of mathematical thought, changes that mathematician Enrico Bombieri discusses in his contribution. He examines the main philosophical positions in mathematics, with a writing enriched with episodes from his own personal experience. He discusses Platonic realism (mathematics exist independently of us), formalism (mathematics is only a construction of the mind, and mathematical statements are consequences of the allowed rules), and social constructivism (mathematics is a product of culture, influenced by racism and ethnocentrism). Bombieri also reflects on how recent progress in computer science that allow now computers to do probabilistic proof-checking has modified the notion of proof in mathematics.

The discussion at San Marino clearly documented ways in which human reason engages in the search for truth in accordance with a wide spectrum of approaches, a spectrum that encompasses many elements besides logical reasoning. The dynamical relation between trust and desire is one of the most important of these elements. Philosopher Linda Zagzebski argues that human beings have a natural primary desire for truth, and that trust that such desire for truth can be satisfied leads to self-trust – as opposed to doubt. This self-trust leads in turn to trust in others and the desire for understanding and meaning. She then criticises both strong and weak forms of epistemic egoism, as well as the concept of epistemic autonomy. Linda Zagzebski further argues that trust that the desire for truth can be satisfied leads to trust

that other natural desires are also satisfiable. In particular, the desire for connectedness to the universe is highly relevant for the formation of religious beliefs. The philosopher Peter Van Inwagen examines the notion of objective truth as it figures in both political and philosophical discourse. In philosophy, he considers the realist (facts exist independently from us and are more or less discoverable) as opposed to the anti-realist position (there is no objective truth on beliefs and statements). It is interesting to note the analogy of these two positions –though with different interpretations– with those of realist and constructivist positions in mathematics, as described in Bombieris paper. Van Inwagen then compares the current debate among philosophers in academic circles on objective truth to the fictional debate on the same topic by two characters in the novel 1984, by George Orwell, one of the great political writers of the twentieth century.

2. Outlook

The title of the Rimini Meeting focussed on truth not simply as a philosophical, scientific or theological concept, but as the destiny of each human individual — as the ultimate goal of every human life. Truth as destiny is not mainly communicated through intellectual argument or scientific proof, but through personal witness. The theme science, reason and truth, considered at an academic level at San Marino, was proposed to the much wider audience of the Rimini Meeting as a dialogue in a more personal mode, a round-table discussion, with three of the participants in the San Marino Symposium, Xavier Le Pichon, Paul Davies and Enrico Bombieri. Their round-table discussion provided an opportunity for the over 3,000 people in attendance to encounter three scientists who are both involved in scientific research at the highest level and open to the big questions of truth and ultimate meaning. These initiatives at San Marino and Rimini were attempts to contribute to the invitation by Pope Benedict XVI to “enlarge the area of our rationality, to reopen it to the larger questions of the truth and the good, to link theology, philosophy and science between them in full respect for the methods proper to them and of their reciprocal autonomy, but also in the awareness of the intrinsic unity that holds them together”, as he addressed to the participants in the Fourth Italian Ecclesial Convention in Verona in October 2006. Discussing a fundamental theme such as the nature of truth from a variety of perspectives and approaches may indeed help our awareness of the intrinsic unity which holds together all things and our own lives.

Volume 5
Summer 2013

euresis
Association for the Promotion of the Scientific Endeavour